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(54) SURFACE LIGHT SOURCE DEVICE, LIGHT GUIDE PLATE AND DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a surface light source device allowing improvement in luminances between point light sources, when using the plural side-by-side point light sources as a light source, allowing dissolution of luminance irregularities in illumination light and allowing reduction of the number of the point light sources to contribute to reduction of a cost, and to provide a light guide plate for the surface light source device and a display device excellent in display performance using the surface light source device.

SOLUTION: In this surface light source device, a light guide plate 2 is formed with plural recessed parts 211 fitted on LEDs 11, and curved end faces 213 in incident face portions between the recessed parts 211, while each the end face 213 has a reflection member 13. Thereby, lack of light intensity between the LEDs 11 can be compensated to improve the uniformize the luminance. By forming a cutout part 212 in the recessed part 211 on the emission side of light from the LED 11, the light is widely diffused inside the light guide plate 2 so as to uniformize the luminance further.

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CLAIMS

[Claim(s)]

[Claim 1] It has the light source by which two or more point light sources were estranged and established on the substrate, and the light guide plate which carries out incidence of the light from the light source from the plane of incidence of the side, and carries out outgoing radiation from an outgoing radiation side. It is surface light source equipment characterized by establishing two or more crevices corresponding to the point light source in the plane of incidence of a light guide plate, forming the plane-of-incidence part between the crevices of a light guide plate in a curved surface in the surface light source equipment with which fitting of the point light source is carried out to this crevice, and preparing a reflective member in this curved surface.

[Claim 2] A substrate is surface light source equipment according to claim 1 which opposite arrangement is carried out at plane of incidence, and is characterized by equipping with a reflective member the substrate part which counters a curved surface.

[Claim 3] A substrate is surface light source equipment according to claim 2 characterized by being the flexible substrate which has flexibility and the substrate part which counters a curved surface being a reflector as a reflective member.

[Claim 4] Surface light source equipment according to claim 1 to 3 characterized by forming the notch in the Idemitsu [the light from the point light source of a crevice] side.

[Claim 5] Surface light source equipment which carries out the description of having the light source by which two or more point light sources were estranged and established on the substrate, and the light guide plate which carries out incidence of the light from the light source from the plane of incidence of the side, and carries out outgoing radiation from an outgoing radiation side, a notch being prepared in the Idemitsu [the light from the point light source of these crevices] side with two or more crevices which corresponded to the point light source at the plane of incidence of a light guide plate, and fitting of the point light source being carried out to a crevice.

[Claim 6] A substrate is surface light source equipment according to claim 5 which opposite arrangement is carried out at plane of incidence, and is characterized by equipping with a reflective member the substrate part which counters the plane-of-incidence part between crevices.

[Claim 7] It is the light guide plate which is equipped with the plane of incidence which carries out incidence of the light from the light source in which two or more point light sources estranged, and were prepared, the outgoing-radiation side which carries out incidence from plane of incidence, and carries out the outgoing radiation side of the light, two or more crevices where fitting of the point light source is carried out by being prepared in plane of incidence corresponding to the point light source, and the notch prepared in the Idemitsu [the light from the point light source of a crevice] side, and is characterized by to form the plane-of-incidence part between crevices in a curved surface.

[Claim 8] The display characterized by having surface light source equipment according to claim 1 to 6 and the nonluminescent display means formed in an outgoing radiation side side.

DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the surface light source equipment especially using the point light sources, such as LED, about the light guide plate used for surface light source equipment and its surface light source equipment, and the display using the surface light source equipment further.

[0002]

[Description of the Prior Art] In the nonluminescent indicating equipment represented by the liquid crystal display, the back light unit for lighting is prepared in a tooth back. The thing equipped with a reflective sheet for this back light unit to return again the light which opposite arrangement of the light source was carried out on the light source and the side face which is plane of incidence, and was prepared at the light guide plate which carries out incidence from a side face, and which carries out outgoing radiation from an outgoing radiation side, and the light guide plate rear-face side, and escaped from the light from the light source from the rear face in a light guide plate is known. Moreover, a thing equipped with the lens sheet for condensing the light (Hikaru Idei) by which outgoing radiation is carried out from an outgoing radiation side in an angle of visibility if needed, and raising brightness, and the diffusion plate for equalization of brightness is also above an outgoing radiation side.

[0003] Now, the point light sources of a cold cathode fluorescent lamp etc., such as a linear light source and LED, are used for the light source of a back light unit. When using the point light sources, such as LED, as the light source, for example, as it is in the utility model registration No. 2578529 official report, two or more point light sources are put in order in the condition of having estranged, and opposite arrangement is carried out at the plane of incidence of a light guide plate. Moreover, in this utility model registration No. 2578529 official report, in order to make easy positioning of LED to a light guide plate, two or more LED which carried out the resin seal to trapezoidal shape is prepared on a substrate, and it is considering as the configuration which inserts in LED for the ability establishing the crevice into which LED fits in a light guide plate.

[0004]

[Problem(s) to be Solved by the Invention] When using as the light source what put two or more point light sources, such as LED, in order, in the illumination light by which outgoing radiation is carried out from the outgoing radiation side of a light guide plate, it is easy to generate the brightness unevenness corresponding to a place with the point light source, and the place which is not, and becomes so remarkable that the distance between the point light sources becomes long at it. For this reason, it had become [rather than it was easy] the hindrance of the cost cut by reduction of the number of the point light sources to lengthen distance between the point light sources and to reduce the number of the point light sources.

[0005] this invention ** .. it aims at offering the surface light source equipment which was made in view of the point [like], cancels the brightness unevenness of the illumination light while raising the brightness between the point light sources, in case what put two or more point light sources in order is used as the light source, enables reduction of the number of the point light sources further, and can be contributed to a cost cut. Moreover, it aims at offering the light guide plate used for the surface light source equipment, and the display with the sufficient display engine performance using the surface light source equipment.

[0006]

[Means for Solving the Problem] The light source which the point light source of plurality [equipment / of this invention concerning claim 1 / surface light source / top / substrate]

estranged, and was established, It has the light guide plate which carries out incidence of the light from the light source from the plane of incidence of the side, and carries out outgoing radiation from an outgoing radiation side. Two or more crevices corresponding to the point light source are established in the plane of incidence of a light guide plate, it is surface light source equipment with which fitting of the point light source is carried out to this crevice, the plane-of-incidence part between the crevices of a light guide plate is formed in a curved surface, and it is characterized by preparing a reflective member in this curved surface.

[0007] In invention according to claim 1, opposite arrangement of the substrate is carried out at plane of incidence, and the surface light source equipment of this invention concerning claim 2 is characterized by equipping with a reflective member the substrate part which counters a curved surface.

[0008] The surface light source equipment of this invention concerning claim 3 is a flexible substrate with which a substrate has flexibility in invention according to claim 2, and the substrate part which counters a curved surface is characterized by being a reflector as a reflective member.

[0009] The surface light source equipment of this invention concerning claim 4 is characterized by forming the notch in the Idemitsu [the light from the point light source of a crevice] side in invention according to claim 1 to 3.

[0010] It has the light source by which two or more point light sources were estranged and established on the substrate, and the light guide plate which carries out incidence of the light from the light source from the plane of incidence of the side, and carries out outgoing radiation from an outgoing radiation side, a notch is prepared in the Idemitsu [the light from the point light source of these crevices] side with two or more crevices which corresponded to the point light source at the plane of incidence of a light guide plate, and the surface light source equipment of this invention concerning claim 5 carries out the description of fitting of the point light source being carried out to a crevice.

[0011] In invention according to claim 5, opposite arrangement of the substrate is carried out at plane of incidence, and the surface light source equipment of this invention concerning claim 6 is characterized by equipping with a reflective member the substrate part which counters the plane-of-incidence part between crevices.

[0012] The plane of incidence which carries out incidence of the light from the light source which two or more point light sources estranged the light guide plate of this invention concerning claim 7, and was established, It has the outgoing radiation side which carries out incidence from plane of incidence, and carries out the outgoing radiation side of the light, two or more crevices where fitting of the point light source is carried out by being prepared in plane of incidence corresponding to the point light source, and the notch prepared in the Idemitsu [the light from the point light source of a crevice] side, and is characterized by forming the plane-of-incidence part between crevices in a curved surface.

[0013] The display of this invention concerning claim 8 is characterized by having surface light source equipment according to claim 1 to 6 and the nonluminescent display means formed in an outgoing radiation side side.

[0014]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained based on drawing.

[0015] Drawing 1 is the outline block diagram of one example concerning this invention, and shows the outline configuration of the whole display. Drawing 2 is drawing for explaining the important section in drawing 1 .

[0016] As shown in drawing 2 , 1 is the light source established on the substrate 12 after LED11

as the point light source had estranged, and it is prepared between LED11 so that it may counter with the edge surface part which the reflective members 13, such as white or a silver tape, mention later. [two or more]

[0017] It has the rear face 23 which 2 is the light guide plate which consists of a translucency ingredient, and are the outgoing radiation side 22 by which outgoing radiation is carried out while the plane of incidence 21 to which incidence of the light from the light source 1 is carried out, and the light by which incidence was carried out pass through the inside of a light guide plate, and the outgoing radiation side 22 and the field which counters. It is small formed as the thickness of a light guide plate 2, i.e., the distance of the outgoing radiation side 22 and a rear face 23, separates from plane of incidence 21, and improvement in the outgoing radiation effectiveness of outgoing radiation light is achieved with this configuration. In addition, although not illustrated, the diffusion pattern as a diffusion means by which the pattern design was carried out so that the light by which incidence was carried out might carry out outgoing radiation by uniform brightness from the outgoing radiation side 22 may be formed in the rear face 23.

[0018] As for drawing 2, as the condition of having seen from the outgoing radiation side side is shown where the light source 1 and a light guide plate 2 are combined, and shown in this drawing, only the number as LED11 with the same crevice 211 where fitting of each LED11 is carried out is formed in plane of incidence 21, and the notch 212 is further formed in this crevice 211 the opposite side by the side by which a substrate 12 is arranged at the Idemitsu [the light from LED11] side. This notch 212 serves as a semicircle in which a cross-section configuration has the diameter of the almost same die length as the die length of the light exiting surface of LED11, and incidence of the light from LED11 is carried out into a light guide plate 2 from the 212nd page of this notch. In that case, the include angle the light from LED11 carries out [an include angle] incidence to a light guide plate 2 by the notch 212 becomes large, and incidence is carried out so that it may be widely spread to the direction of LED which adjoins each other from a notch 212.

[0019] Moreover, as the edge surface part 213 which is a plane-of-incidence part between a crevice 211 and the adjacent crevice 211 is formed in the curved-surface configuration, for example, is shown in drawing 3, it is desirable to be formed in the curved-surface configuration [like / (a broken line shows)] which condenses between adjacent LED11 near the light source side side face (an alternate long and short dash line shows) of the effective luminescence field of a light guide plate 2.

[0020] in addition, ** -- since it is usually formed by injection molding which used thermoplastics, even if light guide plates [like] are a crevice 211, a notch 212, and a thing further equipped with the edge surface part 213, they can be formed in one and easily by the general forming cycle using metal mold.

[0021] The diffusion plate for opposite arrangement of 3 being carried out on the rear face 23 and side face except plane of incidence 21 and the outgoing radiation side 22, and the reflective sheet for returning again the light which leaked from each side in a light guide plate 2, and 4 being countered and prepared in the outgoing-radiation side 22, and distributing outgoing-radiation light over homogeneity, and 5 are the liquid crystal display panels of the transparency mold as a nonluminescent display means formed in the outgoing radiation side 22 side through the diffusion plate 4. In addition, the lens sheet for condensing light to diffusion plate 4 a top or the bottom, and raising brightness may be prepared, and these diffusion plate 4 and a lens sheet are suitably prepared according to a desired property.

[0022] Now, as shown in drawing 2, where opposite arrangement is carried out, the light source 1 is combined with plane of incidence 21 by the light guide plate 2, at the same time fitting of each LED11 is carried out to a crevice 211 and it is positioned in it, and the reflective member 13 counters the edge surface part 213.

[0023] If it ** and each LED11 of the light source 1 is made to turn on, incidence of the light emitted from LED11 will be carried out into a light guide plate 2 through a notch 212. In case incidence of the light from LED11 is carried out to the field of a notch 212, by carrying out incidence at a comparatively big include angle, incident light is widely diffused to the direction of LED which adjoins each other from a notch 212, and progresses toward an effective luminescence field. Moreover, although a part of light reflects toward edge surface part 213 direction in the 213rd page of an edge surface part and once progresses or comes out of the inside of a light guide plate 2 to the light guide plate 2 exterior from the edge surface part 213 toward an effective luminescence field by reflection and diffusion in the light guide plate 2 interior, it is reflected by the reflective member 13, incidence is again carried out into a light guide plate 2 from the edge surface part 213, and it progresses toward an effective luminescence field.

[0024] In addition, although a notch is a semicircle in which a cross-section configuration has the diameter of the almost same die length as the die length of the light exiting surface of LED11 in this example, you may be the thing of the triangle in which a notch to which the include angle the light from LED carries out [an include angle] incidence to a light guide plate becomes large, for example, a cross-section configuration, has top-most vertices in an effective luminescence field side, and the side which counters has the almost same die length as the die length of the light exiting surface of LED.

[0025] The light from LED11 is widely diffused within a light guide plate 2 as mentioned above, and generating of brightness unevenness is controlled. Furthermore, since light is supplied also about between LED11 which it can increase the amount of outgoing radiation light and the becoming light since light which goes in the edge surface part 213 direction can also be advanced to an effective luminescence field, the improvement in brightness tends to be attained by the edge surface part 213 and the reflective member 13 of a curved-surface configuration, and tends to become comparatively dark at coincidence, brightness unevenness is canceled and equalization of the brightness in an effective luminescence field can be attained.

[0026] And while the light which advanced to the effective luminescence field in a light guide plate 2 advances further, it is reflected with the reflective sheet 3, incidence of the light which leaked from reflection or a rear face 23 with the rear face 23 is again carried out into a light guide plate 1, and outgoing radiation is carried out from the outgoing radiation side 22. The light which carried out outgoing radiation illuminates the liquid crystal display panel 5 from a tooth back through the diffusion plate 4 from the outgoing radiation side 22. With this lighting, the display which does not have brightness unevenness in the screen of a liquid crystal display panel brightly is realized, and the good display engine performance is presented.

[0027] Moreover, it becomes possible to lengthen distance while LED is arranged, without reducing the engine performance, since the lack of the quantity of light between LED can be compensated. That is, it becomes possible to reduce the number of LED required in order to obtain the predetermined engine performance to a certain light guide plate conventionally, and a cost cut can be aimed at.

[0028] Although the reflective member 13 which counters the edge aspect 213 is formed in the substrate 12 in the example shown in drawing 1 and drawing 2, white or the silver thing which tape adhesion was carried out, or printing, vacuum evaporation, etc. carried out metal membranes, such as white or silver ink, and aluminum, and was prepared may be used directly at the edge aspect 213, without preparing in a substrate 12.

[0029] As [fix / it does not restrict to this example, for example, a substrate is arranged at the rear face side of a light guide plate, and / moreover, / as long as the reflective member is formed in the edge aspect 213 / although, as for the light source 1, a substrate 12 is formed in plane of incidence 21 and the sense to counter to a light guide plate 2 / in the example shown in drawing 1

and drawing 2 , / by the rear face side / LED] Furthermore, LED may be fixed to the flexible substrate which has flexibility by the shape of a film instead of the substrate of the comparatively hard quality of the material like a printed circuit board.

[0030] The example which used the flexible substrate for the substrate at drawing 4 is shown. a light guide plate -- two -- a configuration -- and -- LED -- 11 -- drawing 1 -- and -- drawing 2 -- being the same -- although -- a substrate -- 12 -- ' -- flexibility -- having -- flexible -- a substrate -- it is -- a point -- and -- this -- a substrate -- 12 -- ' -- a front face (field which is a part while especially LED11 is formed, and counters with the edge aspect 213) -- white or the point that it is silver and this field has the function of a reflective member -- it is . Thus, a front face mixes a pigment for example, with a substrate ingredient, or white and silver substrate 12' are obtained by forming paint or a metal membrane in a front face.

[0031] Since a high location precision can be acquired for anchoring to a light guide plate 2 and the reflective member of another object is not needed in spite of not needing a not much high location precision in an example as shown in drawing 4 in the case of immobilization of LED11 to substrate 12', it is possible to be able to perform reduction of components mark and simplification of assembly operation, and to aim at a cost cut further.

[0032]

[Effect of the Invention] This invention is preparing a notch in the Idemitsu [the light from LED of the crevice which fits in LED and this crevice] side, the light from LED diffuses it widely within a light guide plate in a light guide plate, and generating of brightness unevenness is controlled so that clearly from the above explanation. Moreover, the edge surface part which is a plane of incidence part between a crevice and an adjacent crevice is made into a curved surface configuration, and the lack of the quantity of light between LED can be compensated by preparing a reflective member to this edge surface part. Thereby, improvement in brightness and equalization of brightness can be attained. Or since distance while LED is arranged can be lengthened without reducing the engine performance, it becomes possible to reduce the number of LED required in order to obtain the predetermined engine performance to a certain light guide plate conventionally, and a cost cut can be aimed at.

[0033] Furthermore, although simplification of assembly operation can be attained maintaining a certain amount of assembly precision since it has the crevice which fits in LED, simplification and a cost cut of the further assembly operation are possible by using a flexible substrate for a substrate.

[0034] Since it ** and the thing of uniform brightness bright as illumination light is obtained, equipment with the sufficient display engine performance also as a display can be offered.

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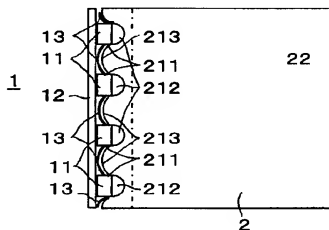
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(54) 【発明の名称】 面光源装置、導光板及び表示装置

(57) 【要約】

【課題】 点光源を複数個並べたものを光源として用いる際に、点光源間の輝度を向上させると共に照明光の輝度むらを解消し、更には点光源数の削減を可能にしてコストダウンに寄与できる面光源装置を提供することを目的とするものである。また、その面光源装置に用いられる導光板、及びその面光源装置を用いた表示性能の良い表示装置を提供することを目的とするものである。

【解決手段】 導光板2にLEDを嵌合する複数の凹部211を設け、凹部と凹部の間の入射面部分で端面213を曲面にし、この端面213に反射部材13を備えることで、LED11間の光量不足を補償でき、輝度の向上及び輝度の均一化を図ることができる。また、凹部211のLEDからの光の出光側に切欠き部212を設けることで、導光板内で広く光が拡散され、更に輝度の均一化が図れる。



【特許請求の範囲】

【請求項 1】 基板上に複数の点光源が離間して設けられた光源と、光源からの光を側方の入射面から入射して出射面から出射する導光板とを備え、導光板の入射面には点光源に対応した複数の凹部が設けられ、該凹部に点光源が嵌合される面光源装置において、導光板の凹部と凹部の間の入射面部分は曲面に形成され、該曲面には反射部材が設けられることを特徴とする面光源装置。

【請求項 2】 基板は入射面に対向配置され、曲面に対向する基板部分に反射部材を備えることを特徴とする請求項 1 に記載の面光源装置。

【請求項 3】 基板は可撓性を有するフレキシブル基板であり、曲面に対向する基板部分が反射部材としての反射面であることを特徴とする請求項 2 に記載の面光源装置。

【請求項 4】 凹部の点光源からの光の出光側に切欠き部が形成されていることを特徴とする請求項 1 乃至 3 のいずれかに記載の面光源装置。

【請求項 5】 基板上に複数の点光源が離間して設けられた光源と、光源からの光を側方の入射面から入射して出射面から出射する導光板とを備え、導光板の入射面には点光源に対応した複数の凹部と共にこれら凹部の点光源からの光の出光側に切欠き部が設けられ、凹部に点光源が嵌合されることを特徴とする面光源装置。

【請求項 6】 基板は入射面に対向配置され、凹部と凹部の間の入射面部分に対向する基板部分に反射部材を備えることを特徴とする請求項 5 に記載の面光源装置。

【請求項 7】 複数の点光源が離間して設けられた光源からの光を入射する入射面と、入射面から入射して光を出射する出射面と、点光源に対応して入射面に設けられ点光源が嵌合される複数の凹部と、凹部の点光源からの光の出光側に設けられた切欠き部とを備え、凹部と凹部の間の入射面部分は曲面に形成されていることを特徴とする導光板。

【請求項 8】 請求項 1 乃至 6 のいずれかに記載の面光源装置と、出射面側に設けられる非発光表示手段とを備えることを特徴とする表示装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は面光源装置及びその面光源装置に用いる導光板、更にはその面光源装置を用いた表示装置に関し、特に LED 等の点光源を用いた面光源装置に関するものである。

【0002】

【従来の技術】 液晶表示装置に代表される非発光表示装置においては、背面に、照明のためのバックライトユニットが設けられる。このバックライトユニットは、例えば、光源と、入射面である側面に光源が対向配置され光源からの光を側面から入射し出射面から出射する導光板と、導光板裏面側に設けられ裏面から抜けた光を再び導

光板内に戻すための反射シートとを備えるものが知られている。また、出射面の上方には、必要に応じて、出射面から出射される光（出射光）を視野角内に集光し輝度を向上させるためのレンズシートや、輝度の均一化のための拡散板を備えるものもある。

【0003】 さて、バックライトユニットの光源には、冷陰極蛍光灯等の線状光源や LED 等の点光源が用いられる。光源として LED 等の点光源を用いる場合、例えば、実用新案登録第 2578529 号公報にあるように、複数の点光源は離間した状態で並べられ、導光板の入射面に対向配置される。また、この実用新案登録第 2578529 号公報では、導光板に対する LED の位置決めを容易にするために、台形状に樹脂封止した LED を基板上に複数個設け、導光板には LED が嵌合する凹部を設けてこれに LED を嵌め合わせる構成としている。

【0004】

【発明が解決しようとする課題】 LED 等の点光源を複数個並べたものを光源として用いる場合、導光板の出射面から出射される照明光には、点光源の有るところと無いところに対応した輝度むらが発生しやすく、点光源間の距離が長くなるほど顕著になる。このため、点光源間の距離を長くして点光源の数を減らすことは容易ではなく、点光源数の削減によるコストダウンの妨げとなっていた。

【0005】 本発明は、ス様な点に鑑みてなされたもので、点光源を複数個並べたものを光源として用いる際に、点光源間の輝度を向上せんと共に照明光の輝度むらを解消し、更には点光源数の削減を可能にしてコストダウンに寄与できる面光源装置を提供することを目的とするものである。また、その面光源装置に用いられる導光板、及びその面光源装置を用いた表示性能の良い表示装置を提供することを目的とするものである。

【0006】

【課題を解決するための手段】 請求項 1 に係る本発明の面光源装置は、基板上に複数の点光源が離間して設けられた光源と、光源からの光を側方の入射面から入射して出射面から出射する導光板とを備え、導光板の入射面には点光源に対応した複数の凹部が設けられ、該凹部に点光源が嵌合される面光源装置であって、導光板の凹部と凹部の間の入射面部分は曲面に形成され、該曲面には反射部材が設けられることを特徴とする。

【0007】 請求項 2 に係る本発明の面光源装置は、請求項 1 に記載の発明において、基板は入射面に対向配置され、曲面に対向する基板部分に反射部材を備えることを特徴とする。

【0008】 請求項 3 に係る本発明の面光源装置は、請求項 2 に記載の発明において、基板は可撓性を有するフレキシブル基板であり、曲面に対向する基板部分が反射部材としての反射面であることを特徴とする。

【0009】 請求項 4 に係る本発明の面光源装置は、請

求項 1 乃至 3 のいずれかに記載の発明において、凹部の点光源からの光の出光側に切欠き部が形成されていることを特徴とする。

【0010】請求項 5 に係る本発明の面光源装置は、基板上に複数の点光源が離間して設けられた光源と、光源からの光を側方の入射面から入射して出射面から出射する導光板とを備え、導光板の入射面には点光源に対応した複数の凹部と共にこれら凹部の点光源からの光の出光側に切欠き部が設けられ、凹部に点光源が嵌合されることを特徴とする。

【0011】請求項 6 に係る本発明の面光源装置は、請求項 5 に記載の発明において、基板は入射面に対向配置され、凹部と凹部の間の入射面部分に対向する基板部分に反射部材を備えることを特徴とする。

【0012】請求項 7 に係る本発明の導光板は、複数の点光源が離間して設けられた光源からの光を入射する入射面と、入射面から入射して光を出射面する出射面と、点光源に対応して入射面に設けられ点光源が嵌合される複数の凹部と、凹部の点光源からの光の出光側に設けられた切欠き部とを備え、凹部と凹部の間の入射面部分は曲面に形成されていることを特徴とする。

【0013】請求項 8 に係る本発明の表示装置は、請求項 1 乃至 6 のいずれかに記載の面光源装置と、出射面側に設けられる非発光表示手段とを備えることを特徴とする。

【0014】

【実施の形態】以下、本発明の実施の形態を図に基づいて説明する。

【0015】図 1 は本発明に係る一実施例の概略構成図であり、表示装置全体の概略構成を示すものである。図 2 は図 1 における要部を説明するための図である。

【0016】1 は図 2 に示すように、点光源としての LED 11 が離間した状態で複数個基板 12 上に設けられた光源で、LED 11 間には白色あるいは銀色のテープ等の反射部材 13 が後述する端面部 2 に対向するように設けられている。

【0017】2 は透光性材料から成る導光板で、光源 1 からの光が入射される入射面 21、入射された光が導光板内を通過しながら出射される出射面 22、出射面 22 に対向する面である裏面 23 を備え、導光板 2 の厚さ、即ち出射面 22 と裏面 23 との距離は入射面 21 から離れるに従って小さく形成されており、この形状により出射光の出射効率の向上が図られている。尚、図示しないが、裏面 23 には、入射された光が出射面 22 から均一な輝度で出射するようにパターン設計された拡散手段としての拡散パターンが形成されている。

【0018】図 2 は、光源 1 と導光板 2 を組合わせた状態で出射面側から見た状態を示しており、この図にあるように、入射面 21 には、各 LED 11 が嵌合される凹部 211 が LED 11 と同じ数だけ形成されており、更

にこの凹部 211 には、基板 12 が配置される側とは反対の側、LED 11 からの光の出光側に切欠き部 212 が形成されている。この切欠き部 212 は、断面形状が LED 11 の出光面の長さと同ほば同じ長さの直径を持つ半円となっており、LED 11 からの光はこの切欠き部 212 面から導光板 2 内に入射される。その際、切欠き部 212 により LED 11 からの光が導光板 2 に入射する角度が大きくなり、切欠き部 212 から隣り合う LED 方向に対して広く拡散するように入射される。

【0019】また、凹部 211 と隣り合う凹部 211 との間の入射面部分である端面部 213 は曲面形状に形成されており、例えば図 3 に示すように、隣り合う LED 11 の間で導光板 2 の有効発光領域の光源側側面（一点鎖線で示す）付近に集光する（破線で示す）ような曲面形状に形成されることが望ましい。

【0020】尚、ス様な導光板は、通常、熱可塑性樹脂を用いた射出成形により形成されるので、凹部 211 や切欠き部 212、更には端面部 213 を備えるものであっても、金型を用いた一般的な成形工程により一体的に且つ容易に形成することができる。

【0021】3 は入射面 21 と出射面 22 を除いた裏面 23 及び側面に対向配置され、各面から透れた光を再度導光板 2 内に戻すための反射シート、4 は出射面 22 に対向して設けられ出射光を均一に分布させるための拡散板、5 は出射面 22 側に拡散板 4 を介して設けられた非発光表示手段としての透過型の液晶表示パネルである。尚、拡散板 4 の上側あるいは下側には光を集光して輝度を向上させるためのレンズシートを設けても良く、これら拡散板 4 やレンズシートは、所望の特性に応じて適宜設けられる。

【0022】さて、図 2 に示すように、光源 1 は、各 LED 11 が凹部 211 に嵌合されて位置決めされると同時に入射面 21 に対向配置された状態で導光板 2 に組み合わされ、そして、端面部 213 には反射部材 13 が対向される。

【0023】而して、光源 1 の各 LED 11 を点灯させると、LED 11 からの発せられた光は切欠き部 212 を経て導光板 2 内に入射される。LED 11 からの光は切欠き部 212 の面に入射する際に比較的大きな角度で入射することにより、入射光は切欠き部 212 から隣り合う LED 方向に対して広く拡散し、有効発光領域に向かって進む。また、導光板 2 内部での光の反射・拡散により、一部の光は端面部 213 方向へと向かい、端面部 213 面で反射して導光板 2 内を有効発光領域に向かって進む、あるいは端面部 213 から一旦導光板 2 外部へ出るが反射部材 13 で反射されて再度端面部 213 から導光板 2 内に入射されて有効発光領域に向かって進む。

【0024】尚、本実施例では、切欠き部は断面形状が LED 11 の出光面の長さと同ほば同じ長さの直径を持つ半円であるが、LED からの光が導光板に入射する角度

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が大きくなるような切欠き部、例えば、断面形状が有効発光領域側に頂点を持ち、対向する辺がLEDの出光面の長さとはほぼ同じ長さをもつ三角形のものであってもよい。

【0025】上述のようにして、LED11からの光は導光板2内で広く拡散され、輝度むらの発生が抑制される。更に、曲面形状の端面部213や反射部材13により、端面部213方向に向かう光も、有効発光領域へと進行させることができるので、出射光となる光の量を増やすことができ、輝度向上が可能になり、同時に、比較的暗くなりがちなLED11間についても光が供給されるので、輝度むらが解消され、有効発光領域における輝度の均一化が図れる。

【0026】そして、導光板2内の有効発光領域へと進行した光は、更に進行しながら、裏面23で反射あるいは裏面23から洩れた光は反射シート3で反射されて再度導光板1内に入射され、出射面22から出射される。出射面22から出射した光は、拡散板4を経て液晶表示パネル5を背面から照明する。この照明により液晶表示パネルの表示面には明るく輝度むらのない表示が実現され、良好な表示性能を呈するものとなる。

【0027】また、LED間の光量不足を補償できるので、性能を低下させることなく、LEDが配置される間の距離を長くすることが可能となる。即ち、ある導光板に対して所定の性能を得るために必要なLEDの数を従来より減らすことが可能となり、コストダウンを図ることができる。

【0028】図1及び図2に示す実施例では、端面部213に対向する反射部材13は基板12に設けられているが、基板12に設けずに、端面部213に直接、白色あるいは銀色のテープ接着したり、白色あるいは銀色のインクやアルミ等の金属膜を印刷や蒸着等して設けたものでもよい。

【0029】また、図1及び図2に示す実施例では、光源1は導光板2に対して、基板12が入射面21と対向する向きに設けられるが、端面部213に反射部材が形成されていればこの例に限ることなく、例えば、基板が導光板の裏面側に配置され裏面側でLEDが固定されるようなものであっても構わない。更に、プリント基板のような比較的固い材質の基板ではなく、フィルム状で可撓性を有するフレキシブル基板にLEDが固定されていてもよい。

【0030】図4に、基板にフレキシブル基板を用いた例を示す。導光板2の構成およびLED11は図1及び図2と同じであるが、基板12'が可撓性を有するフレキシブル基板である点、及びこの基板12'の表面(特にLED11が設けられる間の部分で、端面部213と対向する面)が、白色あるいは銀色でありこの面が反射部材の機能を有する点である。このように表面が白色や銀色の基板12'は、例えば、基板材料に顔料を混ぜ合

わせたり、表面に塗装あるいは金属膜を形成するなどすることで得られる。

【0031】図4に示すような例では、基板12'へのLED11の固定の際にあまり高い位置精度を必要としないにも拘わらず導光板2への取付けには高い位置精度を得ることができ、また、別体の反射部材を必要としないので、部品点数の削減や組立作業の簡略化ができ、更にはコストダウンを図ることが可能である。

【0032】

【発明の効果】本発明は、以上の説明から明らかなように、導光板に、LEDを嵌合する凹部と、この凹部のLEDからの光の出光側に切欠き部を設けることで、LEDからの光が導光板内で広く拡散され、輝度むらの発生が抑制される。また、凹部と隣り合う凹部との間の入射面部分である端面部を曲面形状とし、この端面部に対して反射部材を設けることによりLED間の光量不足を補償できる。これにより、輝度の向上及び輝度の均一化を図ることができる。あるいは、性能を低下させることなく、LEDが配置される間の距離を長くすることができるので、ある導光板に対して所定の性能を得るために必要なLEDの数を従来より減らすことが可能となり、コストダウンを図ることができる。

【0033】更に、LEDを嵌合する凹部を備えているので、ある程度の組立精度を維持しながら組立作業の簡略化を図ることができるが、基板にフレキシブル基板を用いることで、更なる組立作業の簡略化やコストダウンが可能である。

【0034】而して、照明光として明るく均一な輝度のものが得られるので、表示装置としても表示性能のよい装置を提供することができる。

【図面の簡単な説明】

【図1】本発明に係る一実施例の概略構成図である。

【図2】図1の実施例に係る面光源装置の部分説明図である。

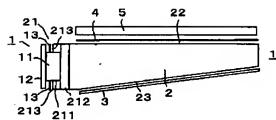
【図3】図1の実施例における要部説明図である。

【図4】本発明の他の実施例に係る面光源装置の部分説明図である。

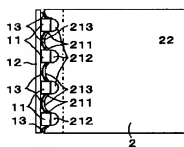
【符号の説明】

- 1 光源
- 11 LED (点光源)
- 12 基板
- 12' フレキシブル基板
- 13 反射部材
- 2 導光板
- 21 入射面
- 211 凹部
- 212 切欠き部
- 213 端面部 (曲面)
- 22 出射面
- 23 裏面

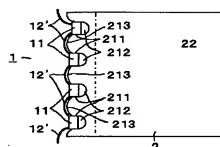
【図 1】



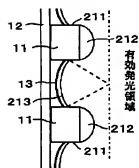
【図 2】



【図 3】



【図 4】



フロントページの続き

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